A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 52003

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019

Second Semester

Mechanical Engineering

15UPH203–MATERIAL SCIENCE

(Common to Chemical Engineering)

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Mobility of electrons is the CO1-R

   (a) flow of electron per unit field

   (b) average electron drift velocity per unit field strength

   (c) reciprocal of conductivity

   (d) average collision time per unit field strength

2. In a dielectric the polarization is CO1-R

   (a) linear function of applied field (b) square function of applied field

   (c) logarithmic function of applied field (d) exponential function of applied field

3. At 0K semiconductor acts as CO2-R

   (a) a superconductor (b) a conductor (c) an insulator (d) a semiconductor

4. If the Hall coefficient is negative then the semiconductor is CO2-R

   (a)) n-type c) d) (b) p-type (c) intrinsic (d) extrinsic

5. The magnitude of Bohr magneton is CO3-R

   (a) 9.27×10^{-24} (b) 9.27×10^{-24} A/m^2

   (c) 9.27×10^{-24} A / m (d) 9.27×10^{-24} A / m^3

6. A superconductor in superconducting state offers ---------- resistance CO3-R

(a) infinite (b) zero (c) low (d) high

7. Metallic glasses are CO4-R

(a) high strength glasses (b) rapidly quenched metals

(c) glasses with metallic impurities (d) metals which are in clay form

8. In nanomaterials with decrease of size the inter atomic spacing CO4-R

(a) increases (b) decreases

(c) first increases and then decreases (d) remains unchanged

9. A line imperfection is called as CO5-R

(a) interstitial defect (b) dislocation (c) grain boundary (d) stacking fault

10. "It is impossible to get a continuous supply of work from a body by cooling it to a temperature lower than that of its surroundings" is the statement of CO5-R

(a) Clausius (b) Mosotti (c) Kelvin (d) Kelvin-Planck

PART – B (5 x 2= 10Marks)

11. Recognize the significance of Fermi energy. CO1-R

12. Distinguish between intrinsic and extrinsic semiconductors. CO2-U

13. Show that superconductor is a perfect diamagnet CO3-U

14. List two applications of nanomaterials CO4-R

15. State Boyle's law CO5-R

PART – C (5 x 16= 80Marks)

16. (a) (i) Based on the classical free electron theory, formulate a mathematical expression to determine the electrical conductivity of metals. CO1-U (12)

(ii) The free electron density in copper at 0K is $8.5 \times 10^{28} / m^3$ and mass of the electron is 9.1×10^{-31} kg. Compute the Fermi energy. CO1-App (4)

Or

(b) (i) Compute the local field for a cubic crystalline structure CO1-App (10)

(ii) Arrive at Clausisus-Mosotti relation CO1-U (6)

17.	(a)	With necessary mathematical background, show that the Fermi level is located exactly at the midpoint of forbidden energy gap.	CO2-U	(16)
		Or		
	(b)	(i) Show that the Hall coefficient is positive for p type semiconducting material	CO2-U	(12)
		(ii) List four applications of Hall effect	CO2- U	(4)
18.	(a)	(i) On the basis of domain theory, explain the hysteresis effect in ferromagnetic materials	CO3-U	(10)
		(ii) Distinguish between hard and soft magnetic materials	CO3-U	(6)
		Or		
	(b)	(i) Why do we prefer type II superconductor for making permanent magnets?	CO3-U	(10)
		(ii) Differentiate between Type – I and Type – II superconductors	CO3-U	(6)
19.	(a)	Illustrate the preparation, properties and applications of metallic glasses	CO4-U	(16)
		Or		
	(b)	Explain the synthesis of nano materials by chemical vapour deposition and ball milling techniques	CO4-U	(16)
20.	(a)	(i) Distinguish ductile and brittle fractures	CO5-U	(8)
		(ii) Explain the four factors affecting the creep resistance of materials	CO5-U	(8)
		Or		
	(b)	Show that the area of the temperature entropy diagram of a Carnot cycle is the useful work done by the engine in one cycle	CO5-U	(16)

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